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NATIONAL AIR INTELLIGENCE CENTER

A BRIEF INTRODUCTION TO THE 28th RESEARCH INSTITUTE

Large-Scale Electronic Systems Engineering
(Selected Pages)

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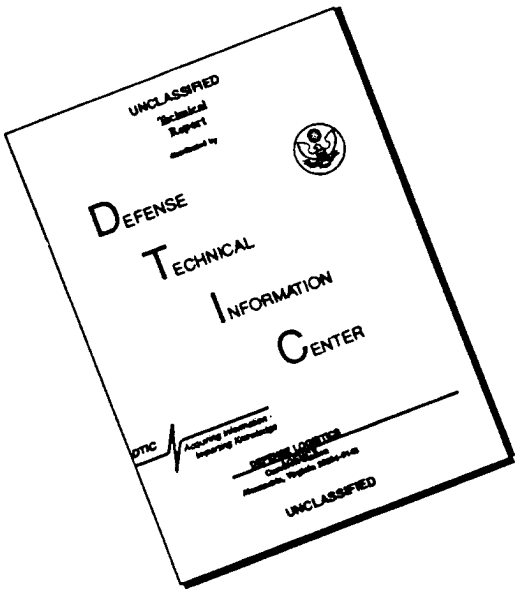

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NAIC-ID(RS)T-0170-96 29 March 1996

MICROFICHE NR: 96C000287

A BRIEF INTRODUCTION TO THE 28th RESEARCH INSTITUTE
Large-Scale Electronic Systems Engineering (Selected Pages)

English pages: 37

Source: 28th Research Institute, IIR 73210123-96; pp. 1-20

Country of origin: China
Translated by: Edward Suter
Requester: NAIC/TACA/Thomas J. Pohlman
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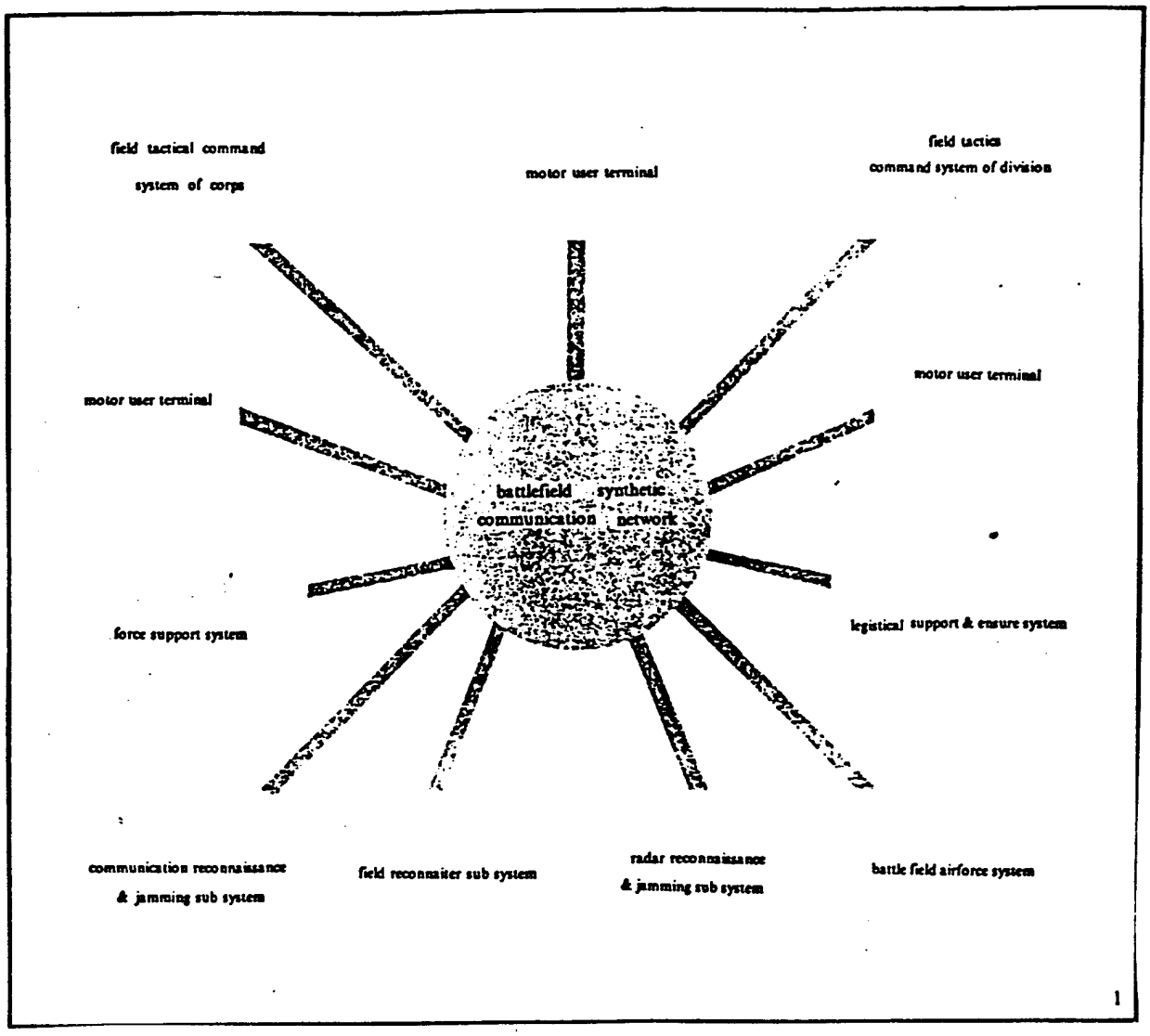
A BRIEF INTRODUCTION TO THE 28TH RESEARCH INSTITUTE

Large-Scale Electronic Systems Engineering



Automated Army Battle Command Systems

The major functions of the automated army battle command systems are:

- Intelligence collection and processing
- Message processing
- Graphics processing
- Retrieval functions
- Auxiliary decisions
- Service processing
- Command and control
- Management functions
- Monitoring functions
- Security functions
- Quantitative positioning functions
- Recording playback
- Simulation exercises

Page 2

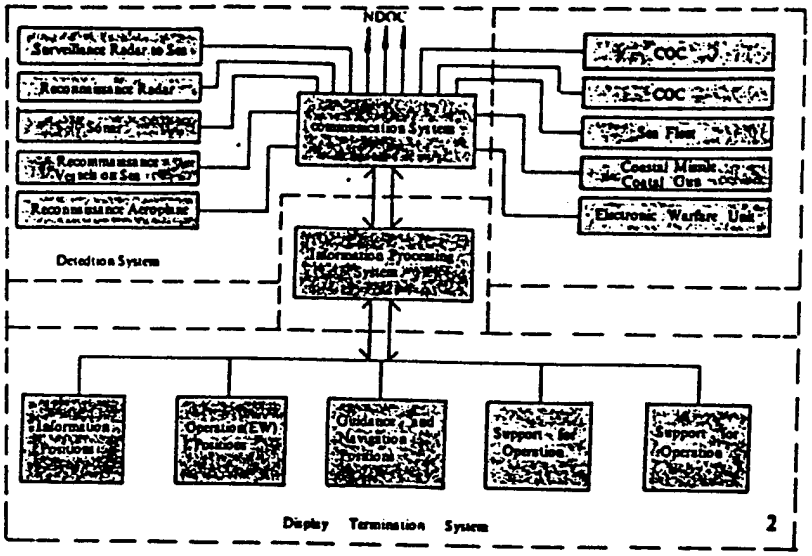
(1). Schematic diagram of the coastal defense area command and control system

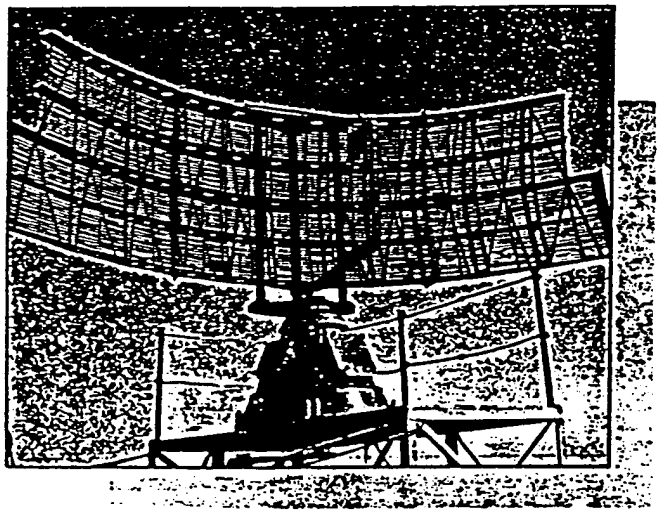
(2). Composite block diagram of the coastal defense area command and control system

(3). Coastal defense radar

(4). Communications equipment

(5). Coastal defense system control center





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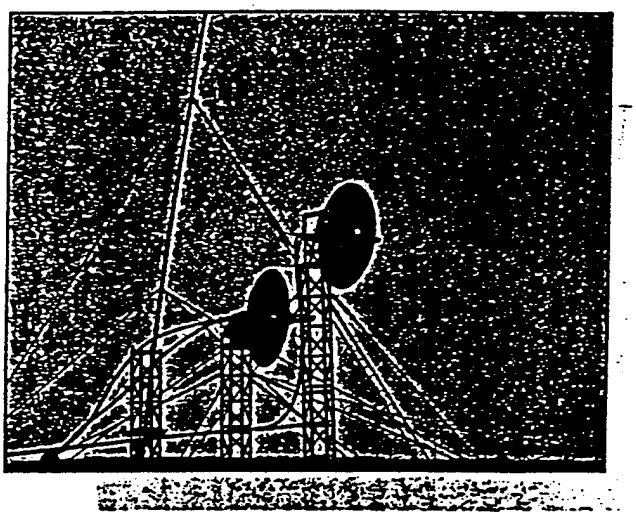

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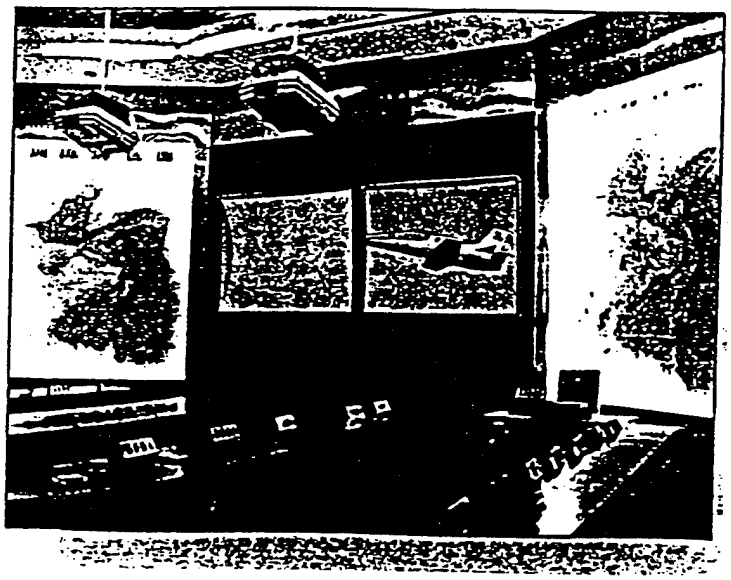


Page 3

Automated Air Traffic Control Systems

Major functions:

• System control range of 512 kilometers

• Implementation of tower control, approach control, and air route control for military and civil aviation

• Real-time flight plan management

• Automated reception processing, AFTN and local flight plans, processing capability: 2000—3000 pieces

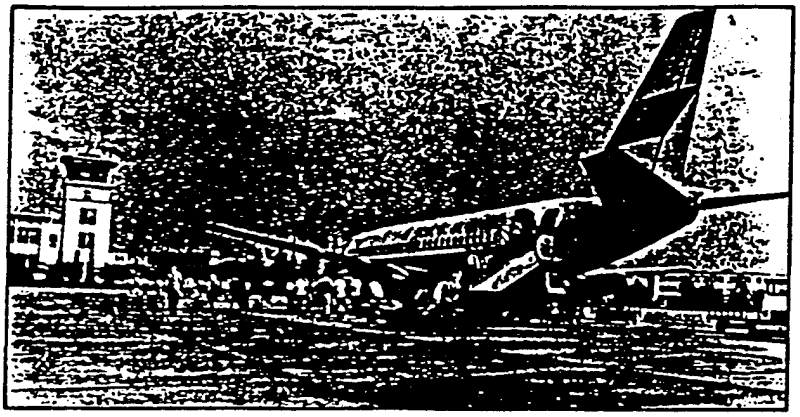
• Short-term flight conflict detection and alert

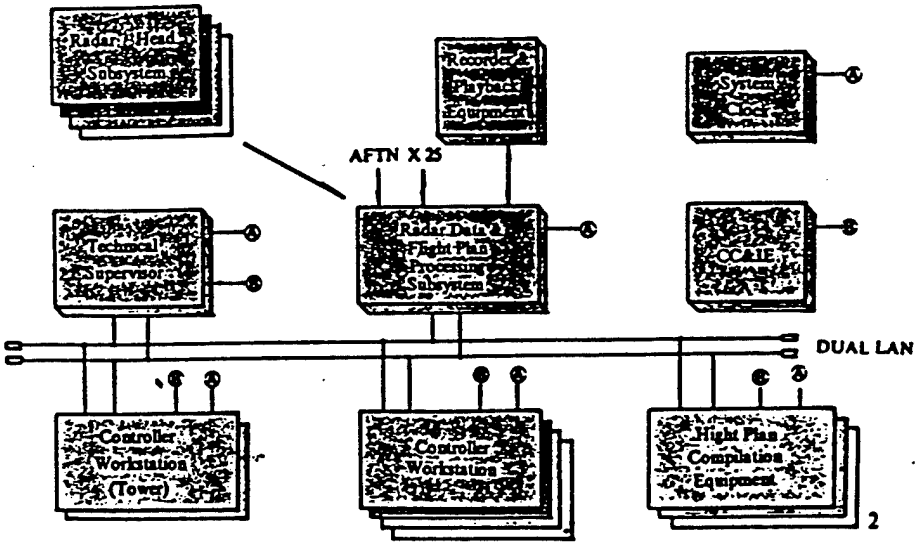
• Flight altitude monitoring and low-altitude alarm signaling

• Special code processing and SPI display and warning

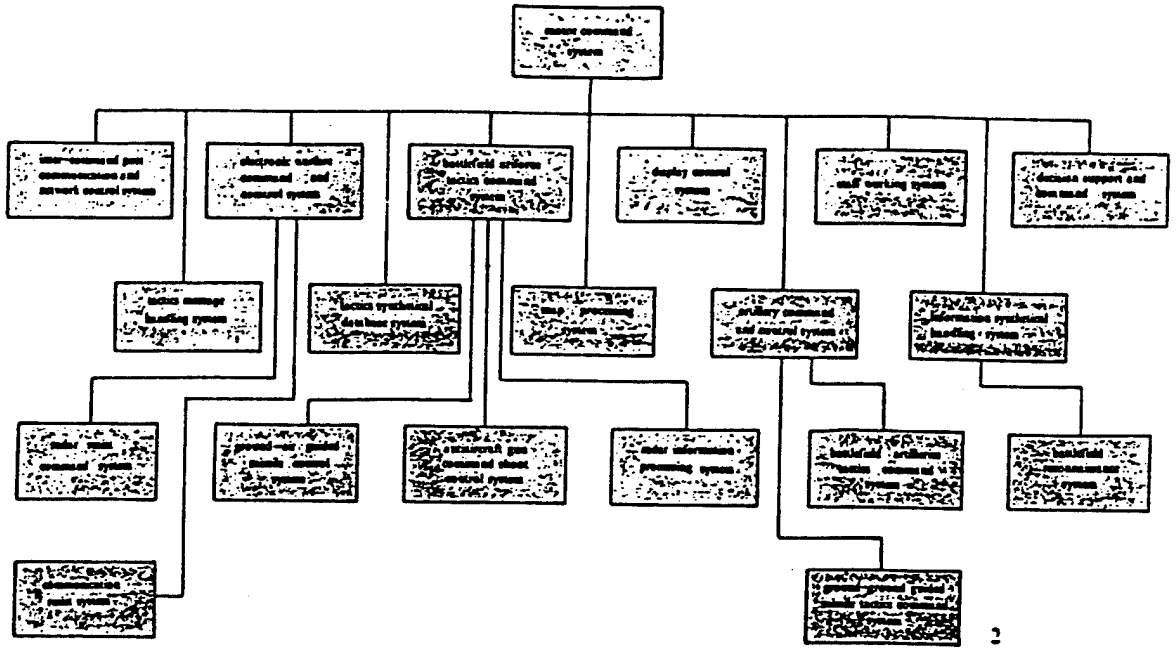
• Centralized control and application of ground-to-air and ground-to-ground radio stations and telephones

• Synchronous recording and playback of radar data, command, communications, and system clock





Page 4



(1). Composite block diagram of the automated group army field operations battle command system

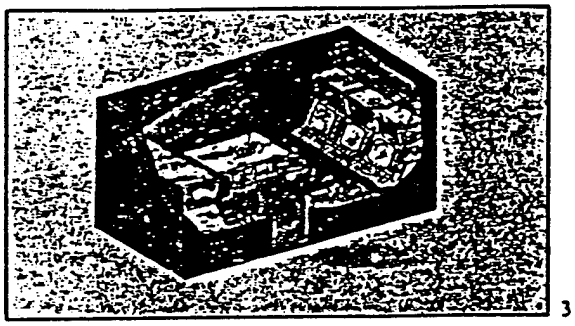
(2). Composite block diagram of the automated [army] division battlefield command system

(3). Battlefield shelter

(4). Command shelter

(5). Communications shelter

(6). Armored command shelter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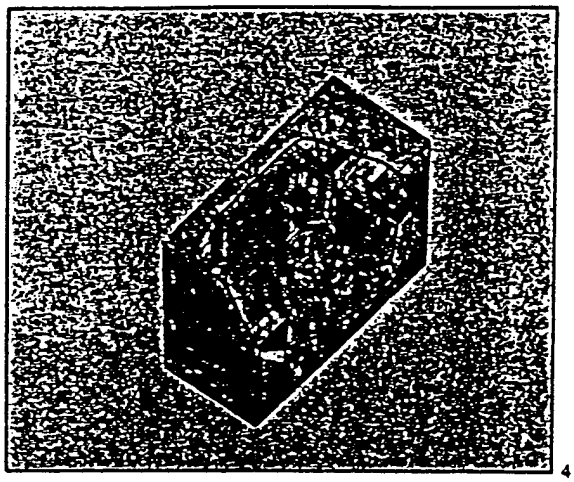
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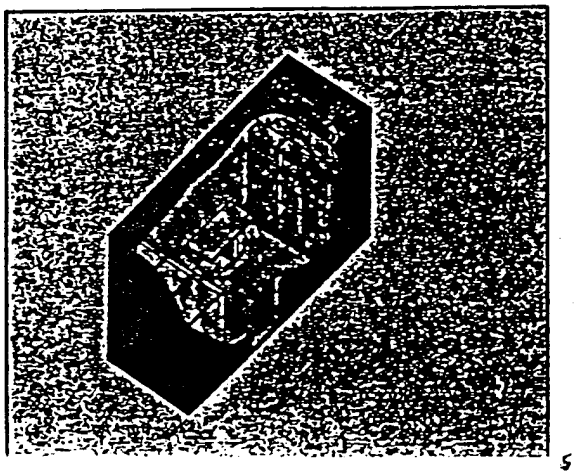
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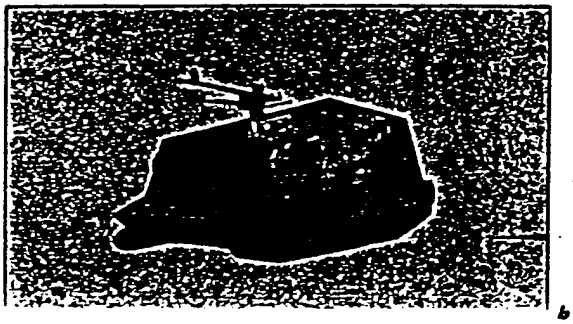

6

(1). Airport

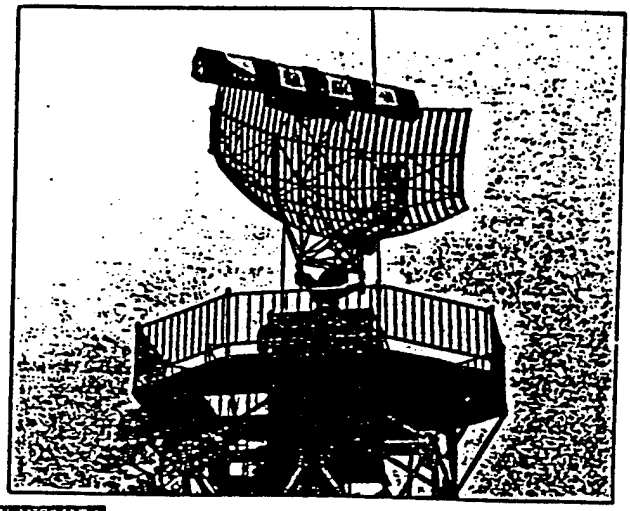
(2). Composite block diagram of the air traffic control system[1]

(3). Combined primary and secondary radars

(4). Tower control console

(5). Flight intelligence compilation console

(6). Radar control console



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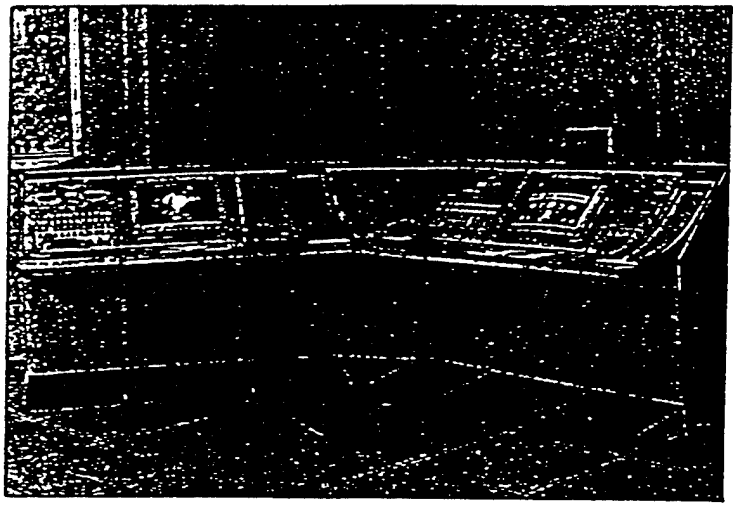
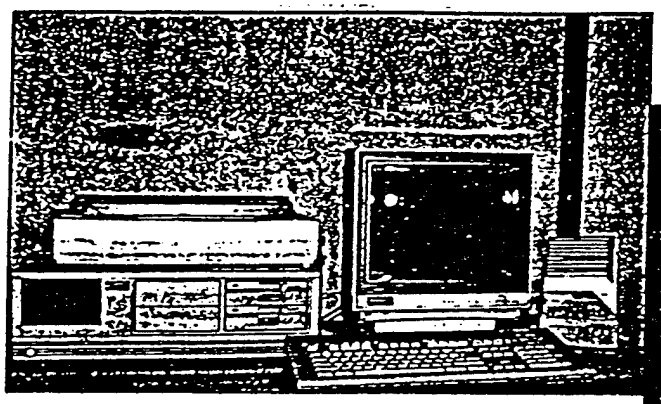


4

[1] Numbers (1) and (2) seem to refer to the photo and diagram on page 3. Pages 3 and 4 may be in inverse order.



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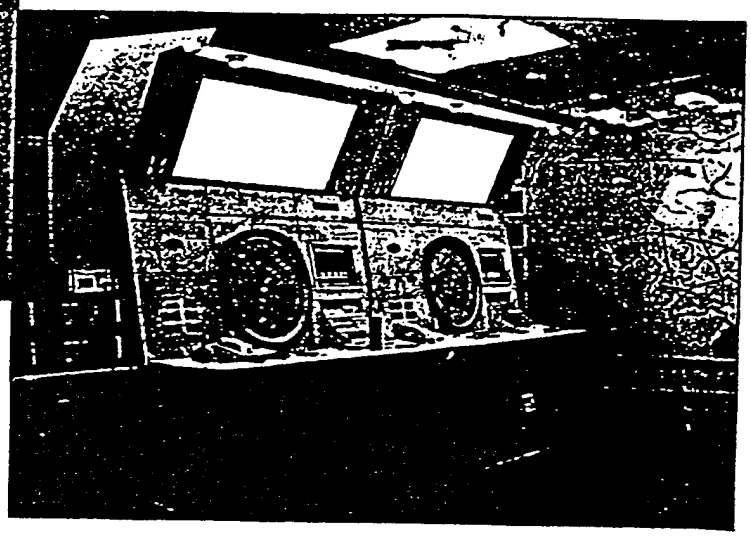


6

Page 6

Automated Urban Traffic Control Systems

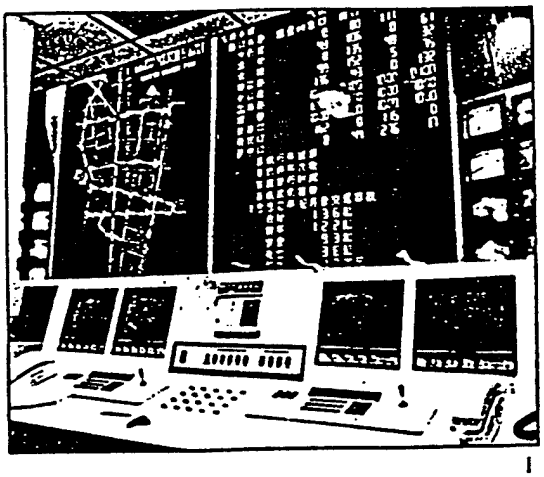
The "Motor Vehicle and Bicycle Mixed Traffic Real-time Adaptive Automated Urban Traffic Control System" developed by the 28th Institute (which puts technology first) is being used for traffic control in the city of Nanjing. In the city proper, which has a 3.8 square kilometer circumference, after this system had been applied to traffic control, driving delays were decreased by 16%, the stopping rate dropped by 17%, travel time was shortened by 21%, and driving speed increased by 15%.

(1). Operations control center

(2). Intersection display image

(3). Intersection [traffic light control] machine

(4). Intersection



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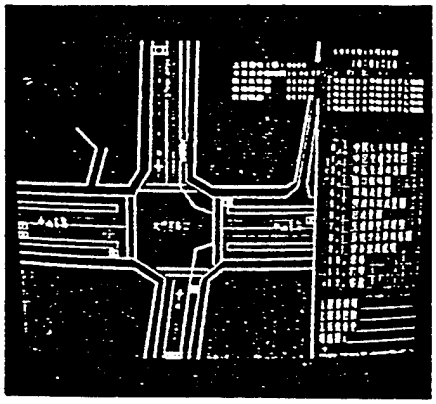

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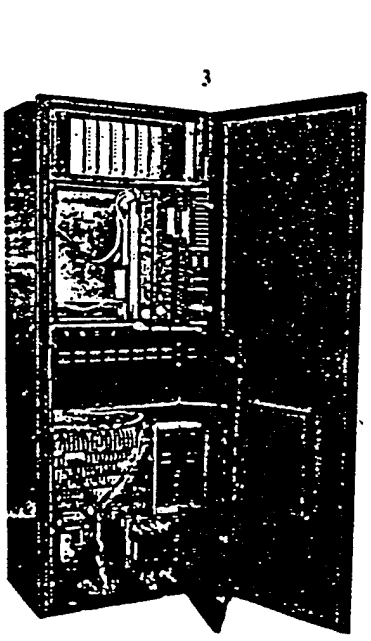

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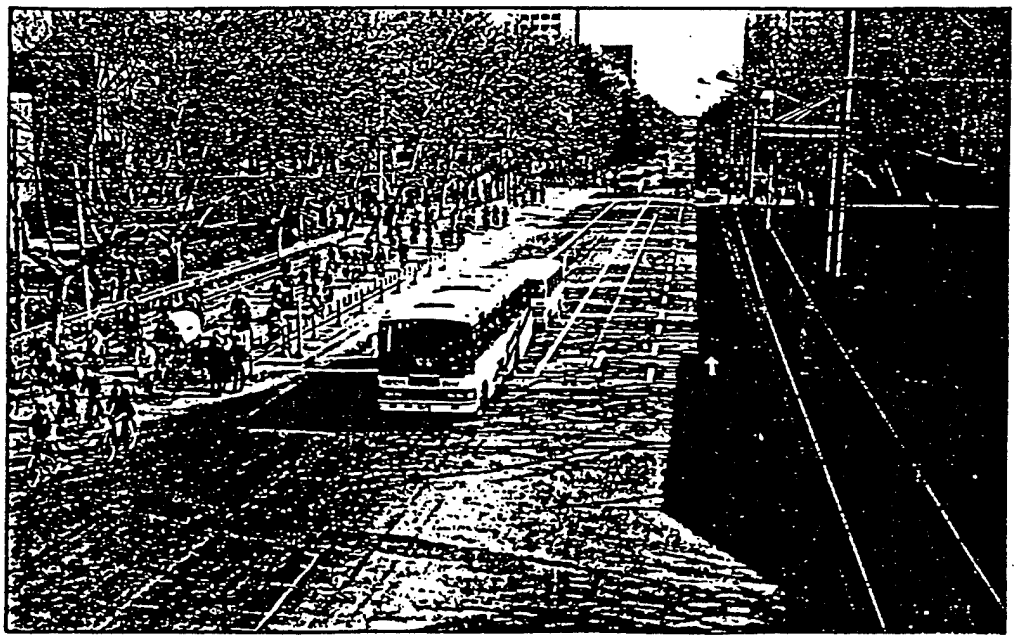


4

Associated Equipment for Large-Scale Electronic Systems

Electronic Plotting Tablet

• Effective area: 80 × 80 cm

• Can [be used for] single person–single pen plotting or simultaneous double pen plotting

• Tablet is covered with transparent, organic glass plate on which maps may be superimposed

• Uses water-based colored pens for plotting, making it easy to wipe off and correct flight paths and symbols

• Duplex output: one circuit conforms to RS232 standard interface serial asynchronous or synchronous output, the other has eight-bit parallel output

• Output speed, word length, and map scale may be modulated

Automated Radar Extraction Equipment

• Can work with different guidance radars or warning radars

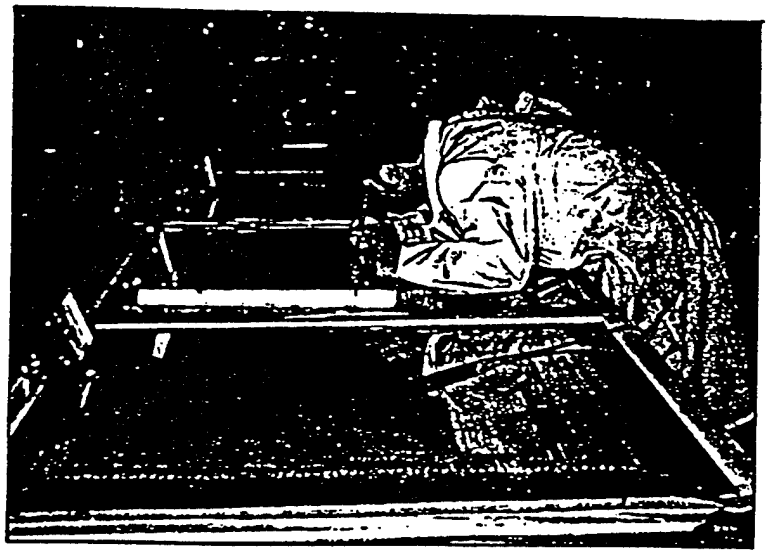
• Extraction operation methods: automatic extraction, semi-automatic extraction, speed tracking, and manual extraction

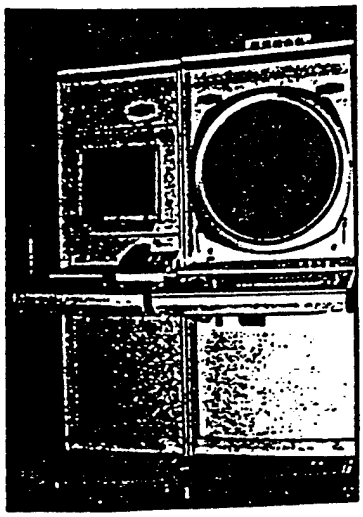
• Receives and processes interrogator response signals, detects IFF traces, and outputs matched pairs

• Can connect two altimetry radar extractors, indicate target planar position, and process matched pair output altitude data

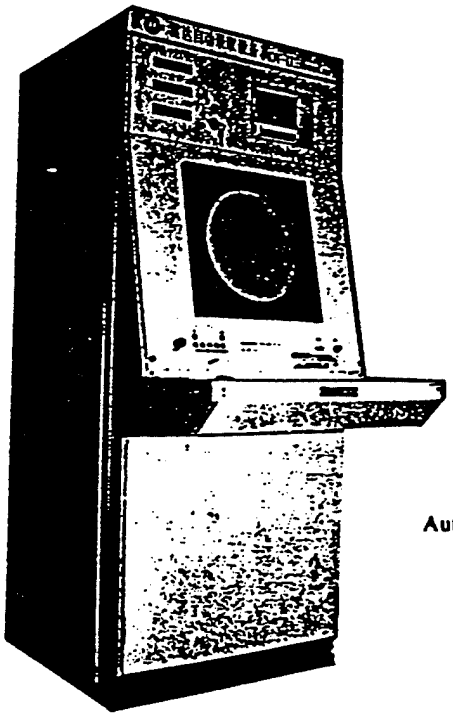
• Can receive duplex low-altitude intelligence, as well as carry out synthetic display and transformation transmission output of coordinates and patterns

• Has duplex communications as well as recording playback functions





405A 雷達自動録取
Automated radar extractor 405 A



ADT−112 雷達自動録取
Automated radar extractor ADT−112

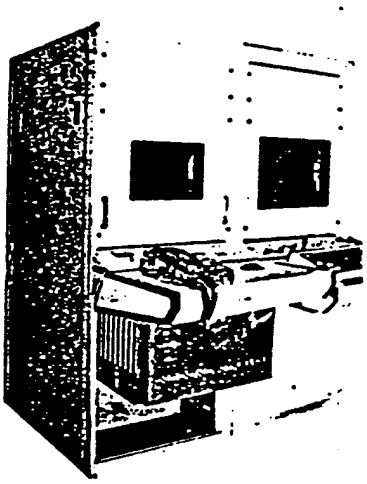
Synthetic Bright Display Console

Computer graphics display technology was combined with radar signal scanning transformation to form a new kind of display equipment which can be used in air traffic control system tower displays and control rooms, military command centers at all levels, military and civil radar stations, and computer graphics display fields.

Large-screen Display Technology

The 28th Institute has researched, developed, and applied:

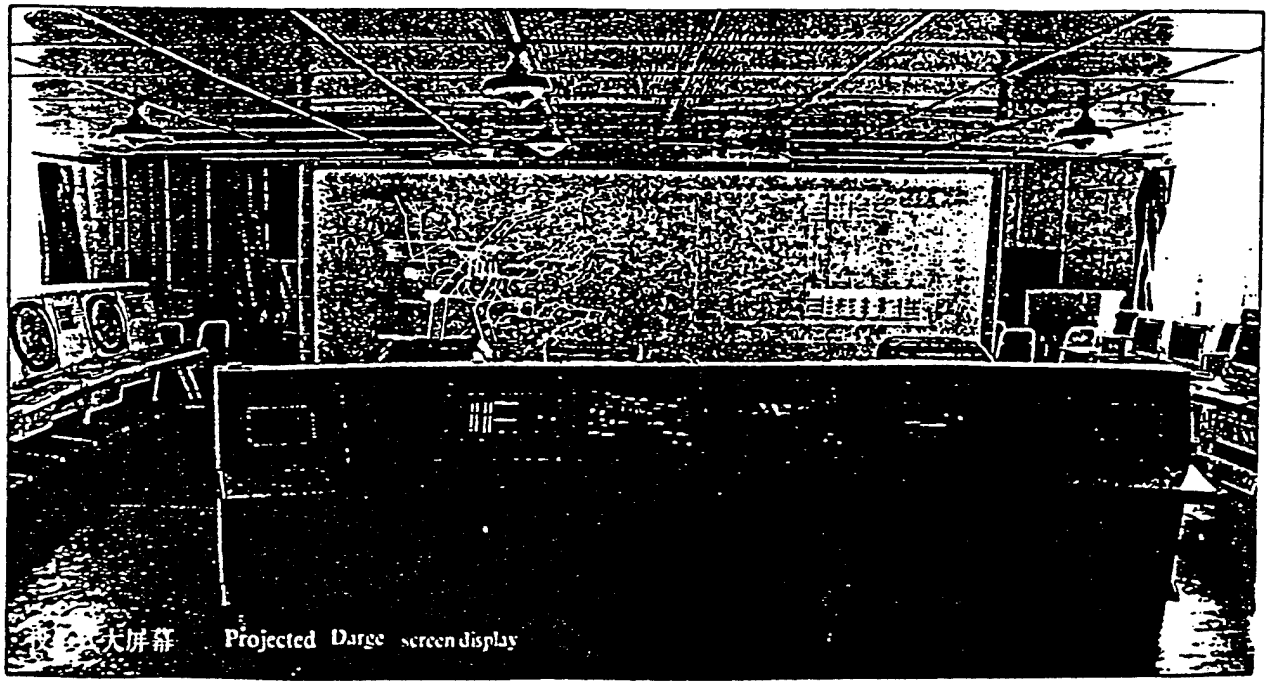
- Liquid crystal light valve large-screen projection color display technology
- Plasma display technology
- Projection television technology



明亮综合显控台
Synthetic bright display console

液晶光阀大屏幕
Liquid crystal light valve large sreen display

等离子大屏幕
Plasma large screen display



Page 9

Vehicle-mounted Display Console

This piece of equipment is especially designed for vehicle-mounted mobile command system use. It uses reinforcement technology and triple-protection treatment. It is highly adaptable and can be installed in mobile shelters, vehicles, trains, and other modes of transportation for mobile operation.

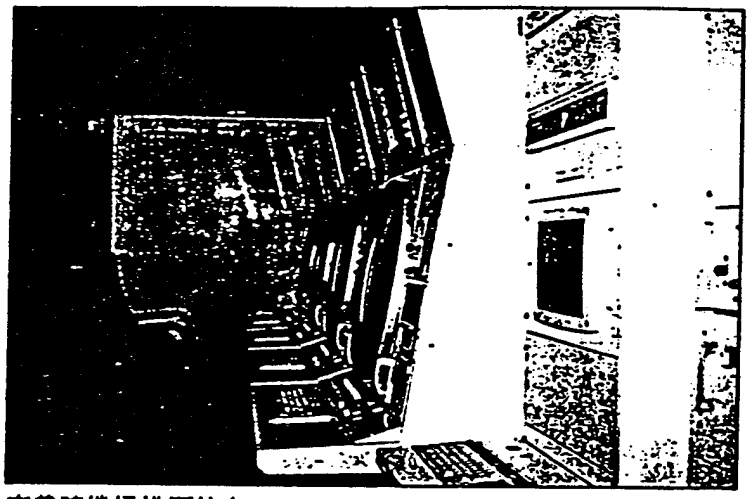
General Purpose Shelters for Electronic Equipment

• Flexible methods of transportation, fast and easy loading and unloading [or: ...assembly and disassembly]

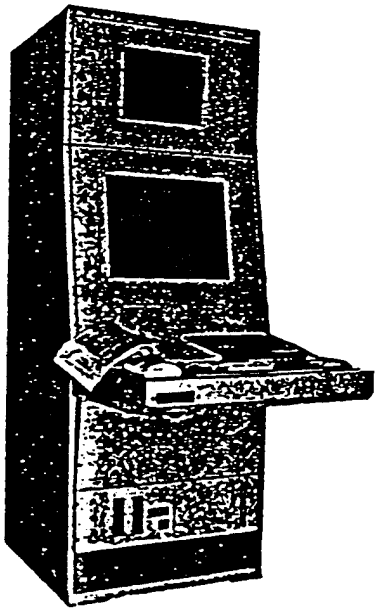
• Tightly sealed (watertight and airtight), well-isolated (electromagnetically shielded, thermally insulated, isolated from shock, etc.)

• Have a full set of internal equipment, including air conditioning, electricity, lighting, water, and sanitary facilities

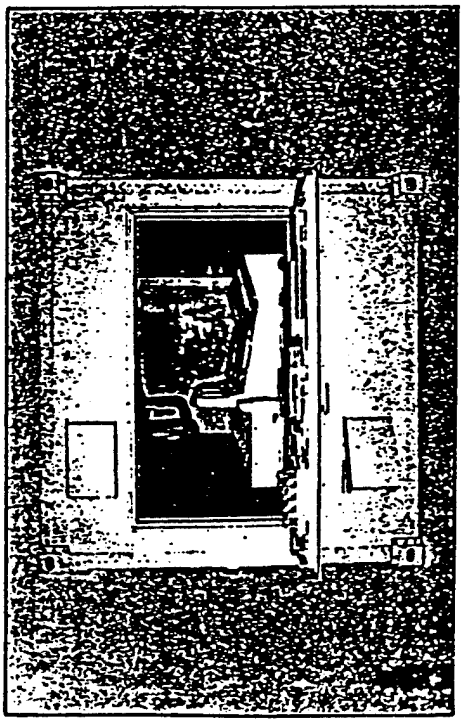
• Serialized, standardized, and interchangeable

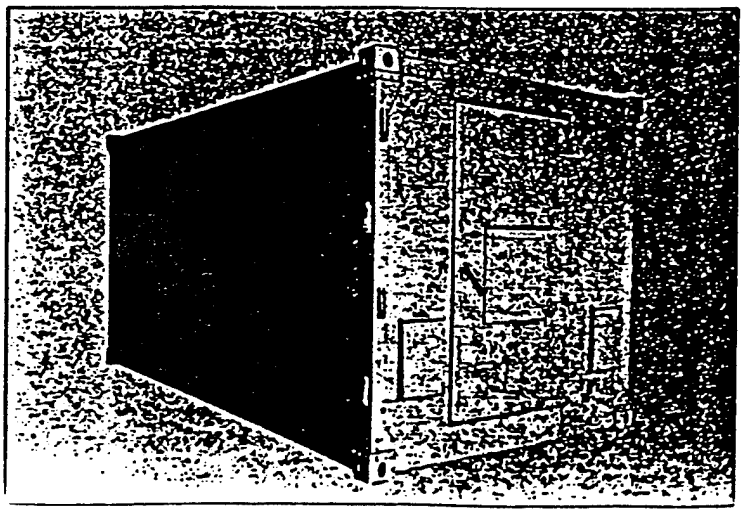


車載隨機掃描顯控台 Display consoles mounted in a shelter



車載光柵掃描控台
Vehicle-mounted raster scanning display console.





電子設備通用方艙
General Parpose Shelter for Electronic Equipment

Page 10

The electronic equipment used in large-scale electronic system engineering developed by the 28th Institute is not only imported from abroad or produced domestically; much of it is developed by the 28th Institute itself. This electronic equipment includes:

General Purpose Random Scanning Display Consoles

- Effective dimensions:
  Main screen diameter: >490 mm

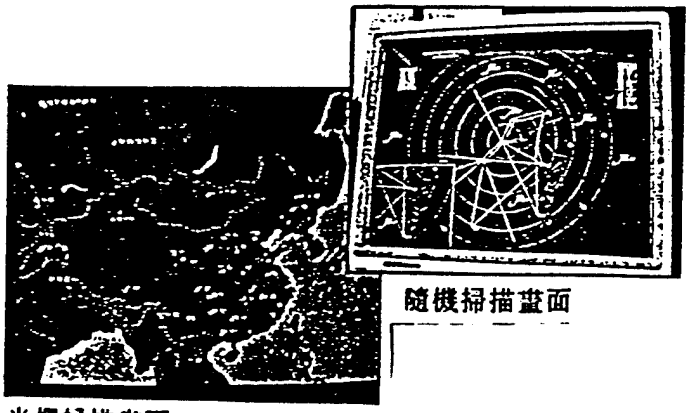
Output screen[2] : 350 mm diagonally

- Off-center screen expansion function
- Artificial interference and extraction functions
- Failure diagnosis function

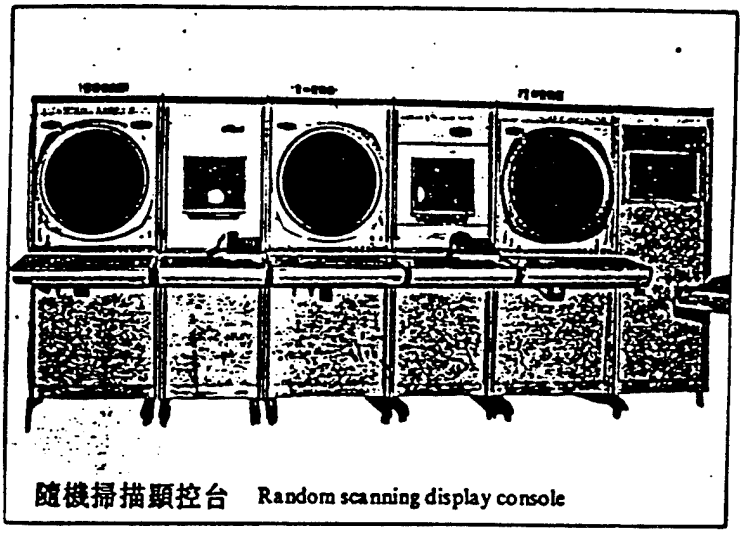
General Purpose Raster Scanning Display Console

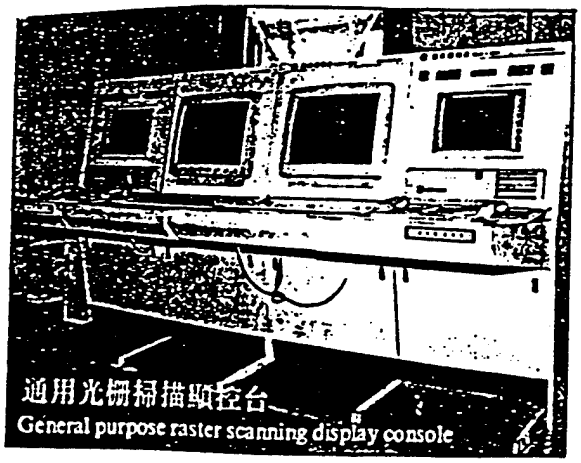
- Main screen dimensions: 480 mm diagonally
- Main screen display format: 1280 × 1024 × 1024
- Main screen color selection: 4096 colors; Colors per frame: 256
- Output screen display format: 40 × 400 NL
- Output screen display capacity: 1000 Chinese characters / 4000 characters
- Hardware plotting capability
- Chinese character functions

[2] "*Fuping*," which literally means "pay screen," was not in any dictionary.



Raster scanning image　　Random scanning image


隨機掃描顯控台　Random scanning display console



Large-scale Electronic System Engineering

Office Automation Systems

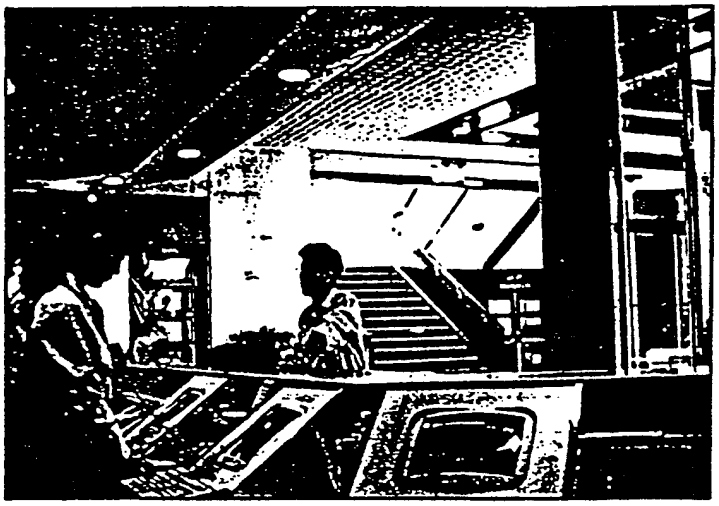
The 28th Institute has successfully developed many information management systems, such as bank management systems, hotel management systems, meteorological relay systems, business and service management systems, etc.

(1). Automated hotel management system

(2). Automated business and enterprise management system

(3). Automated oil field materials management system

(4). Automated meteorological relay system



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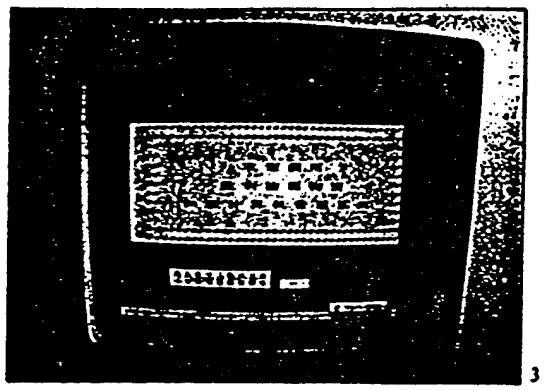

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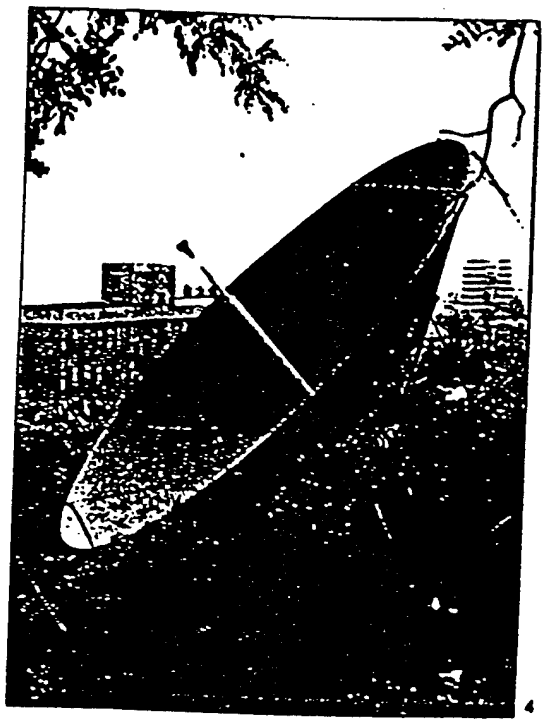


4

Page 12

Production Process Data Collection and Monitoring Systems

This system is used in businesses' industrial process control and automated production management.

Its main functions are:

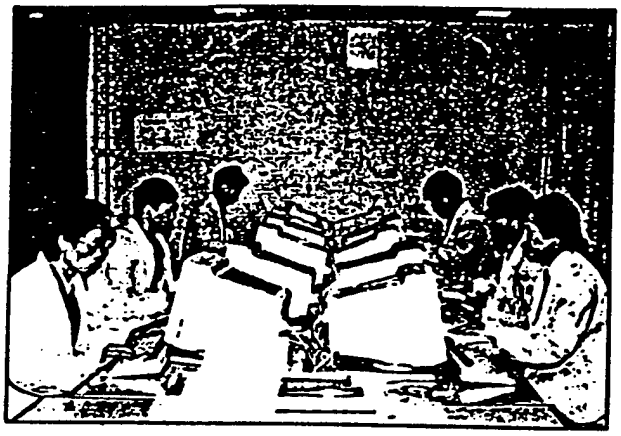
- Real-time dynamic data collection
- Dynamic data processing
- Historical data collection and tendency chart display

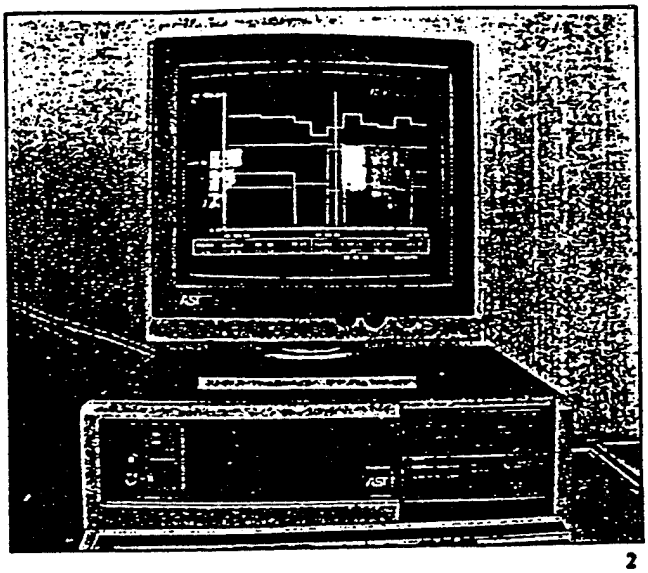
- Real-time dynamic technological parameter graphics display
- Production process flow chart display
- Malfunction warning processing
- Real-time report form printing
- Network interface communications

(1). Computer control center

(2). Production process flow chart

(3). Monitoring center





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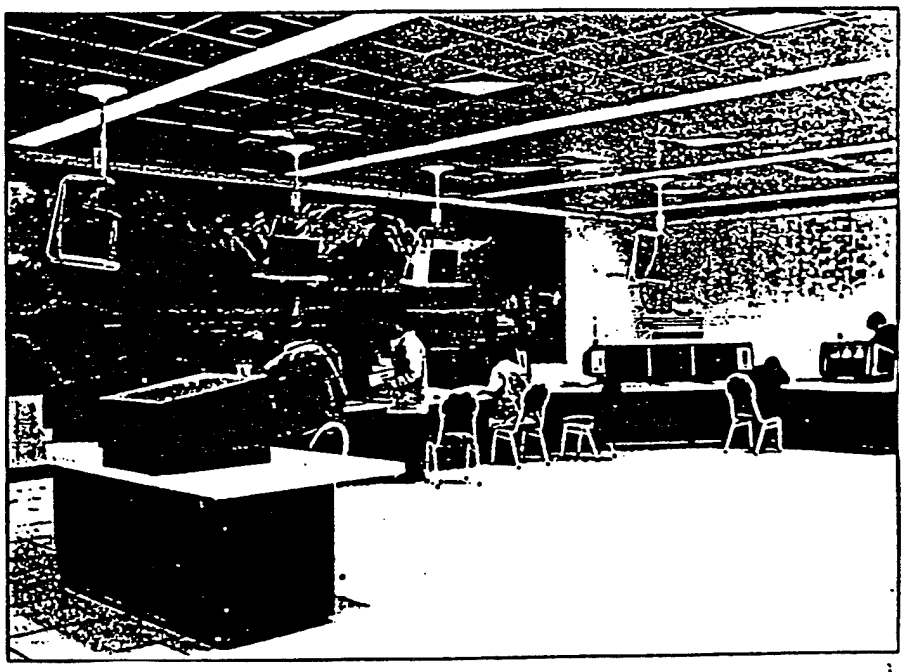


Page 13

Automated Port Traffic Control Systems

Major system functions:

- Obtaining and transmission of information
- Information processing
- Display

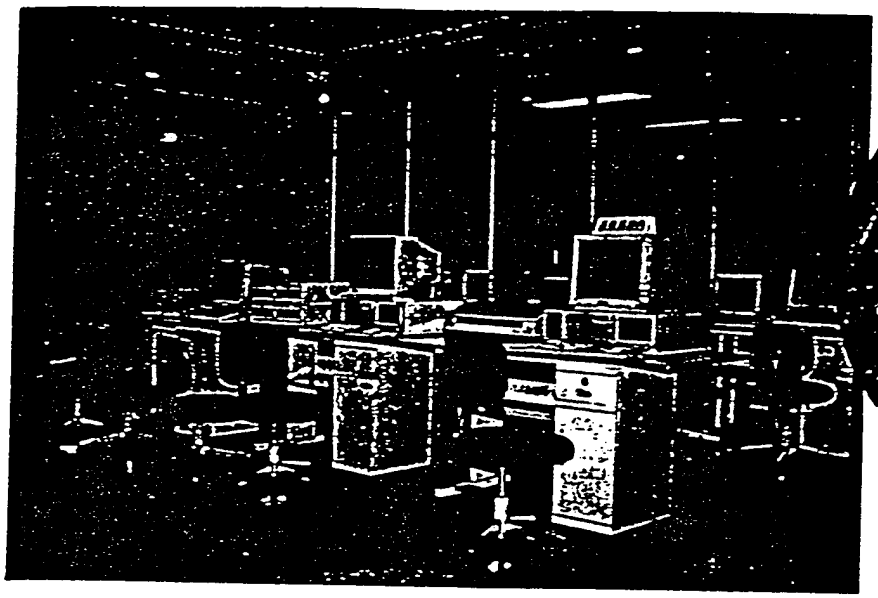
• Ship deployment and processing

(1). System operation center

(2). Display screen

(3). Port management radar

(4). Microwave communications



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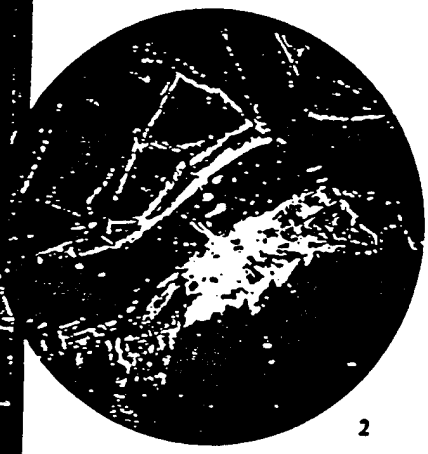

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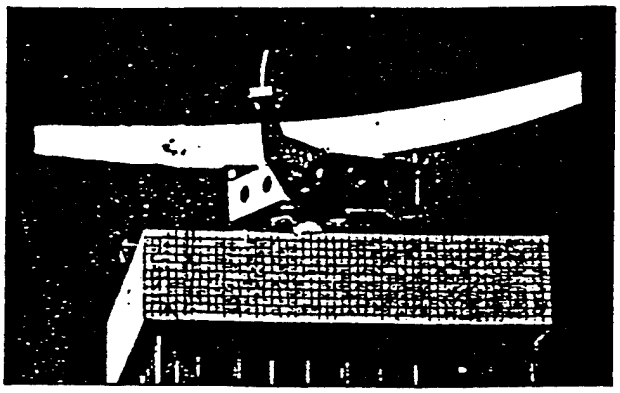

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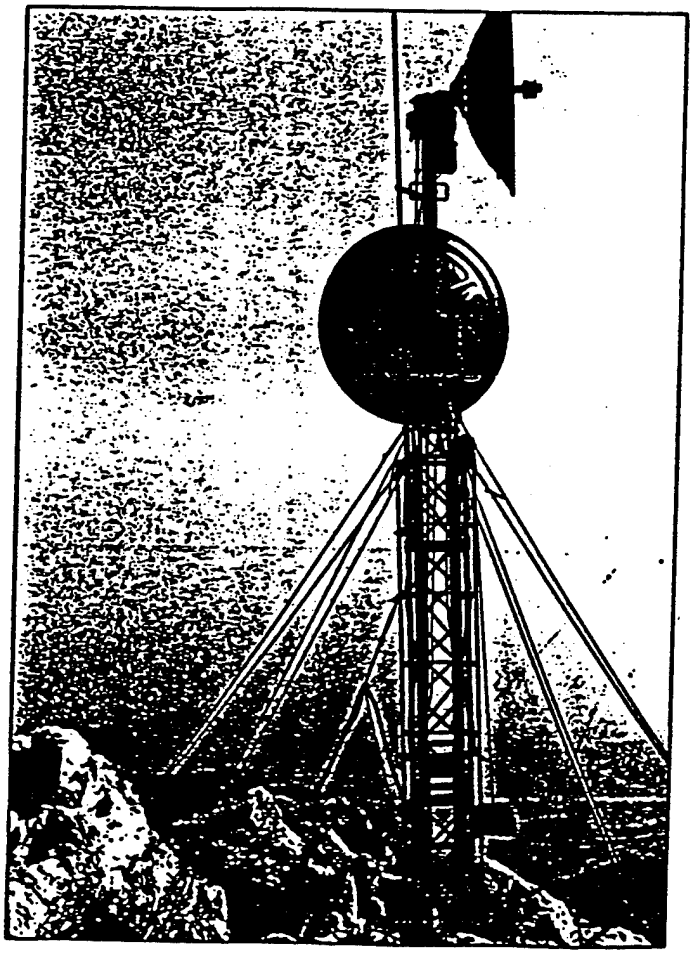


Page 14

Automated Highway Traffic Control Systems

Primary system functions:

• Collection and display of meteorological, installation, project, accident and disaster information, as well as road use conditions

• Detection of traffic flow, vehicle speed, and usage of major highway sections, making statistics for each kind of traffic flow, automatic determination of whether traffic is jammed or flowing

• Providing television monitoring of traffic at important positions along highways

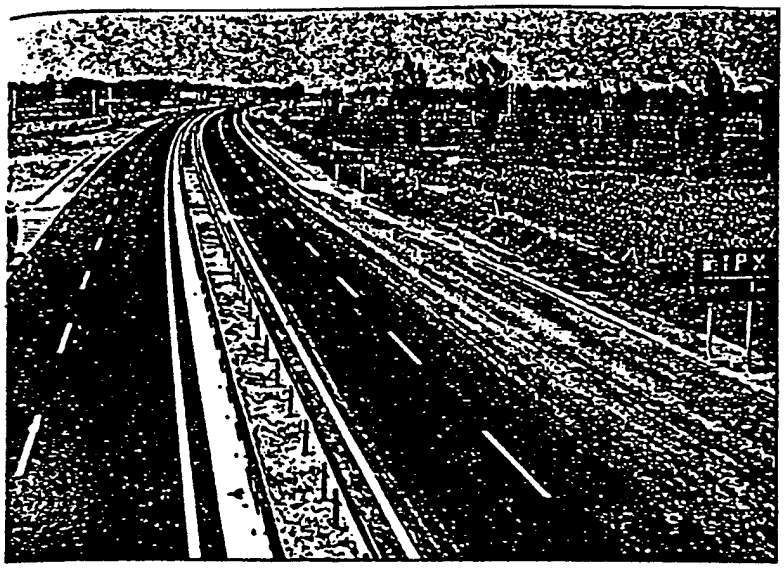
• Toll collection system and database general ledger functions

• Excellent software can calculate optimum conditions for road use

(1). View of a highway

(2). Highway operations and control system

(3). Automated toll-collection system



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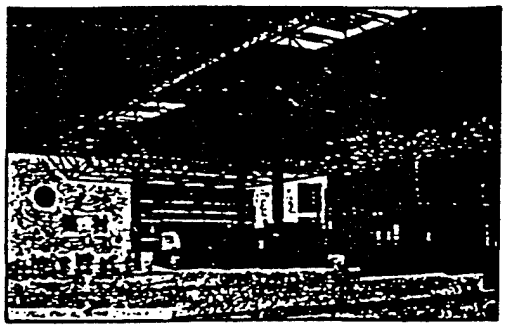

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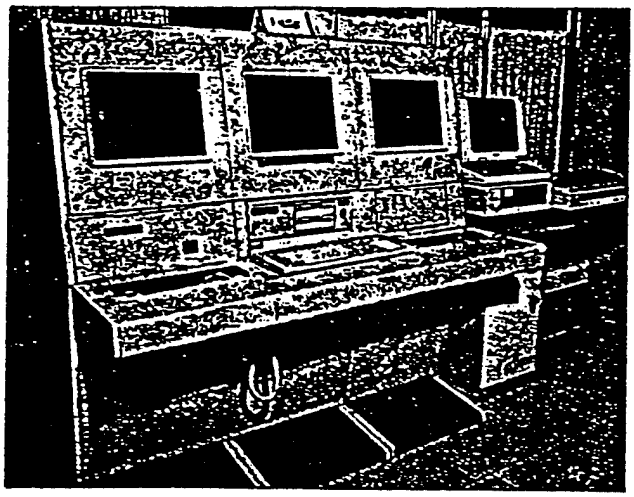


2

Page 15

New High Technology Products

The 28th Institute aims for world advanced levels, carries out research on systems theory, system software, and battlefield assistance in strategic decision-making research, and has set up a voice recognition and voice synthesis laboratory, a systems simulation laboratory, and an image processing laboratory; in addition, it has researched and developed a number of new high-technology products.

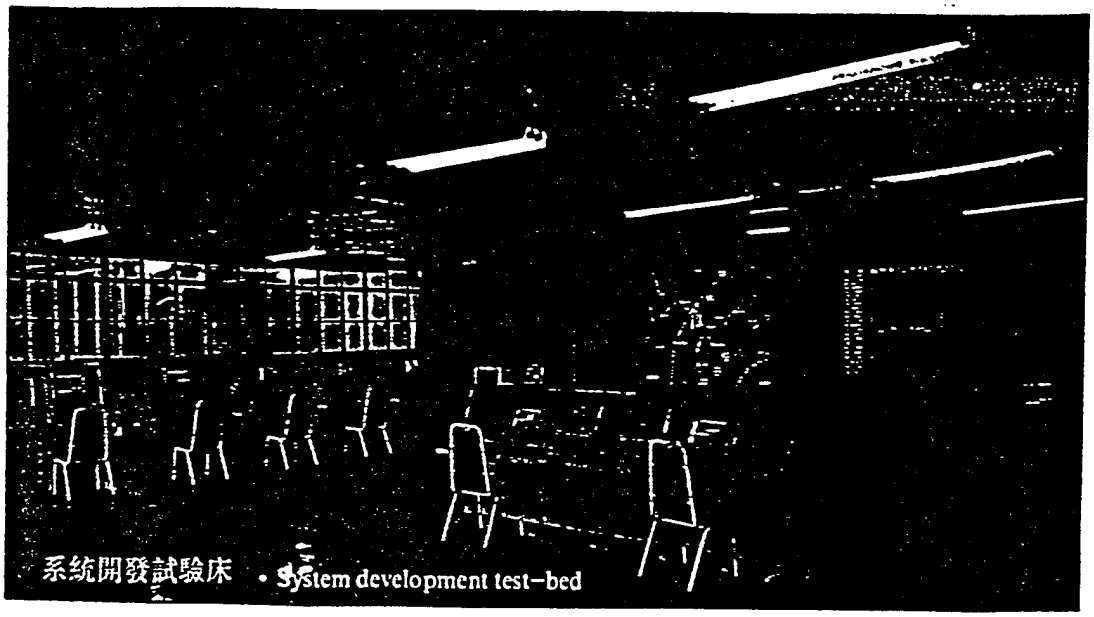
Large System Design Technology

The 28th Institute has hardware and software for simulation and modeling of large system design. It employs large system design technology in military and civil large-scale system engineering design.

Tactical Software Technology

The 28th Institute has a high-level software research and development team which researches and develops system data simulation software and program design software. The real-time software

that this team has researched and developed has already been applied in large-scale military and civil electronic system engineering, and [the team] can undertake development of even higher-level tactical application software.



系統開發試驗床 • System development test-bed

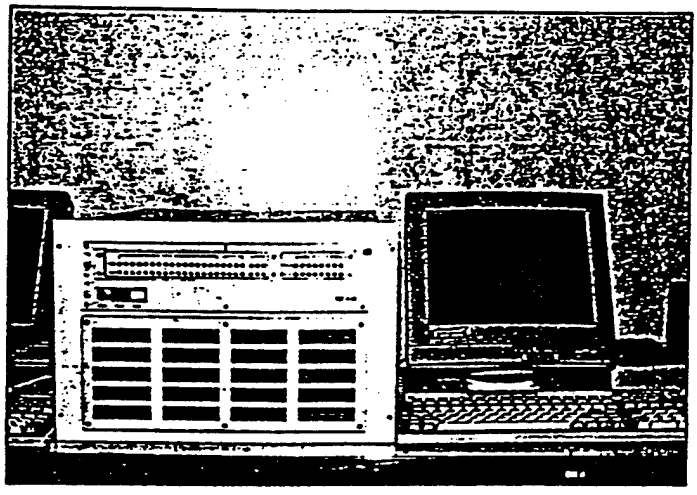
軟件開發工作站

Software development work-station

Associated Equipment for Large-scale Electronic Systems

Multiplex Data Centralized Controller

- Operation methods: Synchronous, asynchronous, fully duplex, semi-duplex
- Transmission speeds: 75, 300, 600, 1200, 2400, 4800 bits per second.
- Acceptable circuits: 8, 16, and 32 circuits
- Interface relationship: RS232C general-purpose standard interface
- Data transmission rate: 32 kb/s
- Checking: Odd-even check, cyclic redundancy check



Vocoder Series of Products

• Good synthesized sound quality, high clarity, can store any sound according to the user's requirements

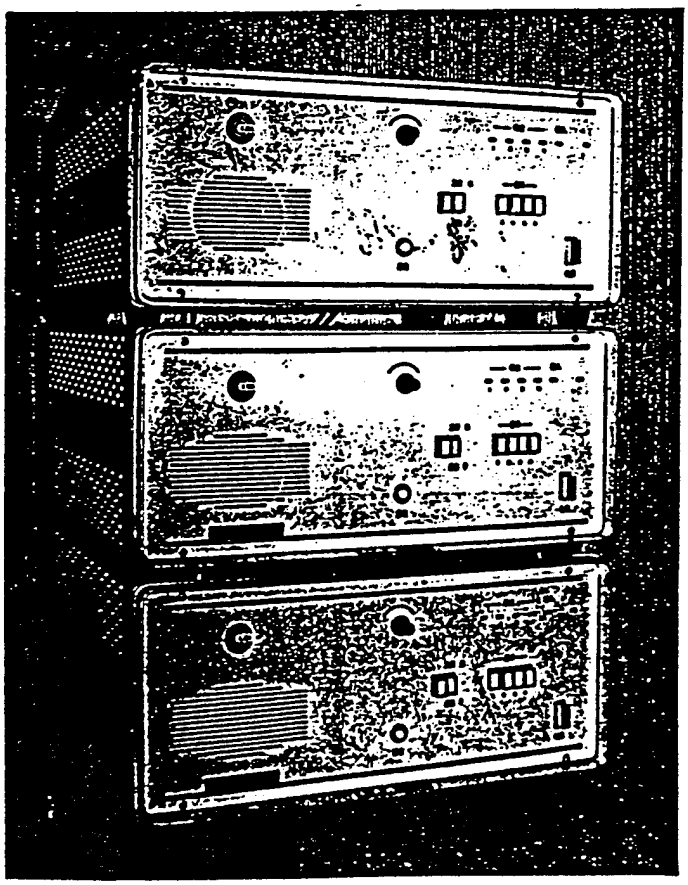
• Convenient interfacing, uses the RS232C serial interface, baud rate may be adjusted

• Can output four different kinds of sounds simultaneously, and output of 16 same-kind sounds can be selected

• Outputs Morse code

• Outputs teletype code

• Rational product design, functions can be augmented according to requirements of user



New High Technology Products

Computer-Aided Design Technology

Possesses machine design functions and electronic design functions

Features:

- Integrated electromechanical design
- Chinese characters, signs, and symbols
- Graphic synchronized dubbing

Computer-Aided Battlefield Technology

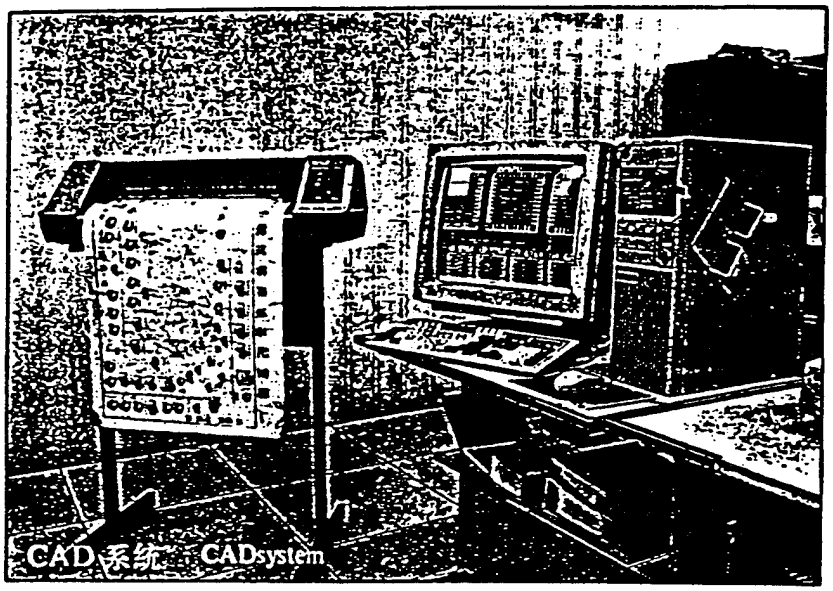
Includes:

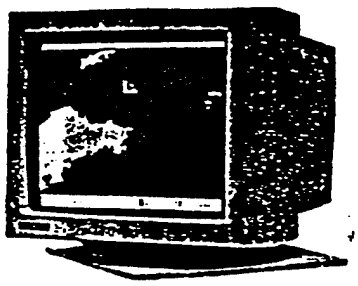
- Analytic model generation technology
- Logic model generation technology
- Knowledge model and knowledge base generation technology
- Expert system technology
- Optimized model and method technology
- Quantitative and qualitative countermeasure technology
- Simulation and modeling technology

System Network Technology

The systems engineering [projects] developed by the 28th Institute all use advanced network technology. They include:

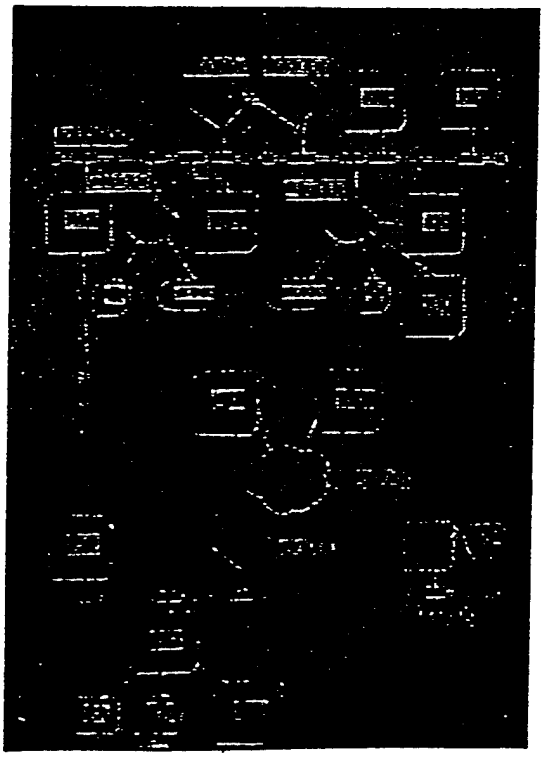
- Local area network and remote network technology
- Dissimilar computer interconnection technology
- Public data network interface technology
- Optical cable communications technology
- Network resource-sharing technology





專家系統

Expert system



網絡配置圖

Network configuration chart

Image Graphics Processing Technology

This technology stores maps and drawings as computer graphics and compiles, splices, magnifies, and reduces them. At the same time, it can carry out many kinds of image processing. Its software displays information in menu forms, and it has a good user interface.

Speech Recognition Technology

The following products have already been developed:

- Speech control systems (SCS) to let computers hear human language[3]
- Chinese character text compilation systems (STS) to let computers hear human language
- Speech automated inquiry service systems (SAS)

Multimedia Display Workstations

This technological product lets the information processed by the computer expand from digital and text information to images (graphics, dynamic images, and television images), sounds (speech, music, sound effects) and other information fields, combines together data processing technology, graphics processing, and other relevant technologies, and thus allows the user to obtain an impressive audio-visual applications environment.

Ultra-High Resolution Display Technology

Displays with resolution of 2048 × 1536 points per frame, or 2048 × 2048 points per frame, are

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[3] *"Ting hua"* is generally translated as "obey," but in this context, "hear language" seems appropriate.

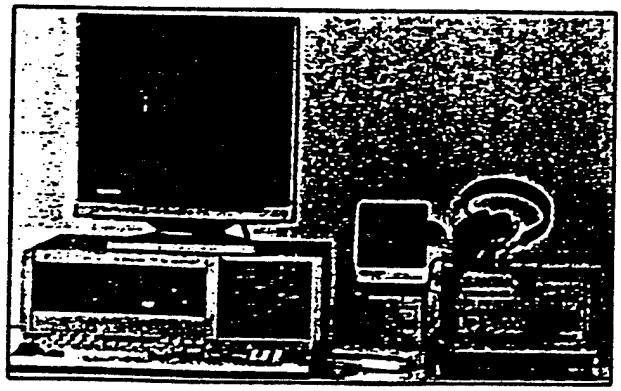
suitable for use in the new generation of C^3I and ATC systems. They provide battlefield commanders, staff officers and controllers with clear, abundant information, and, as required, provide many kinds of tools for convenient human-machine interaction.

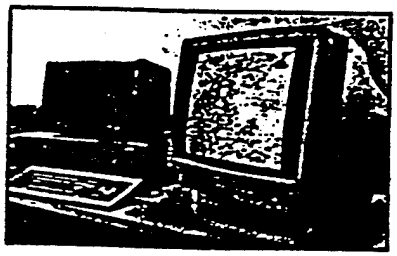
(1). Speech series products

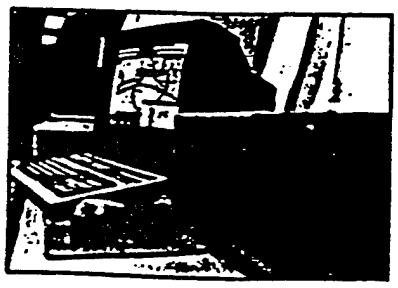
(2). Image graphics processing system

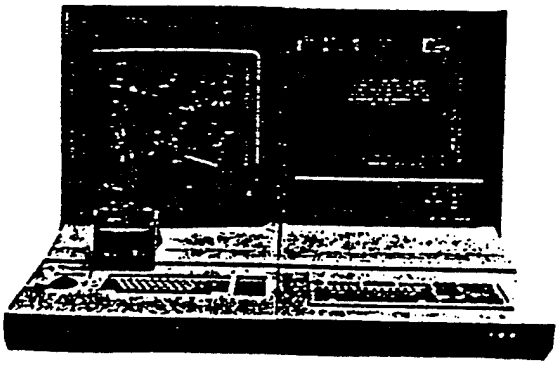
(3). Multimedia display workstation

(4). High-resolution display console









The guiding principle for quality at the 28th Institute is "Quality is number one, and the customer is supreme," and the institute's quality goal is "Put prevention first, succeed the first time." In 1990, [the institute] passed the "quality safeguard system" inspection, and was awarded the "Military Industrial Production Certificate of Quality" by the National Defense Science Industry Committee.

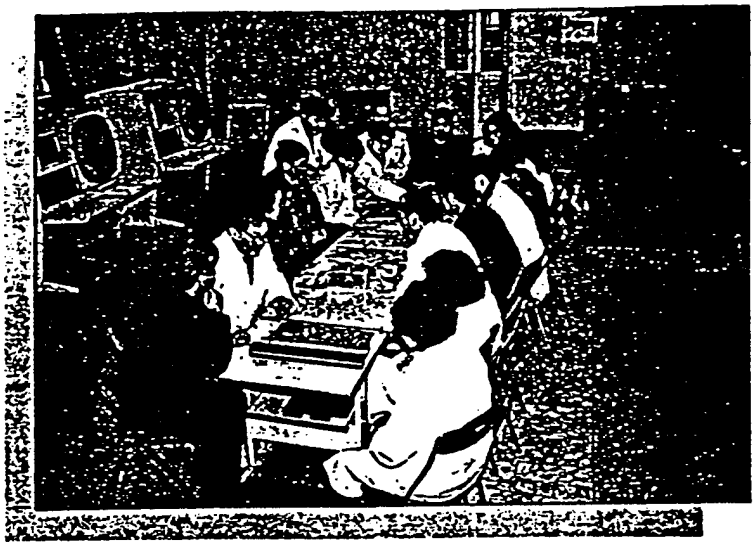
Today, there is a quality control team made up of over 50 people, which has: set up a good quality safeguard system; distributed advanced quality testing and inspection equipment; formulated a set of effective "quality control standards for development of large-scale electronic systems engineering and associated equipment"; and gives "full lifetime technical service" for its products after the sale.

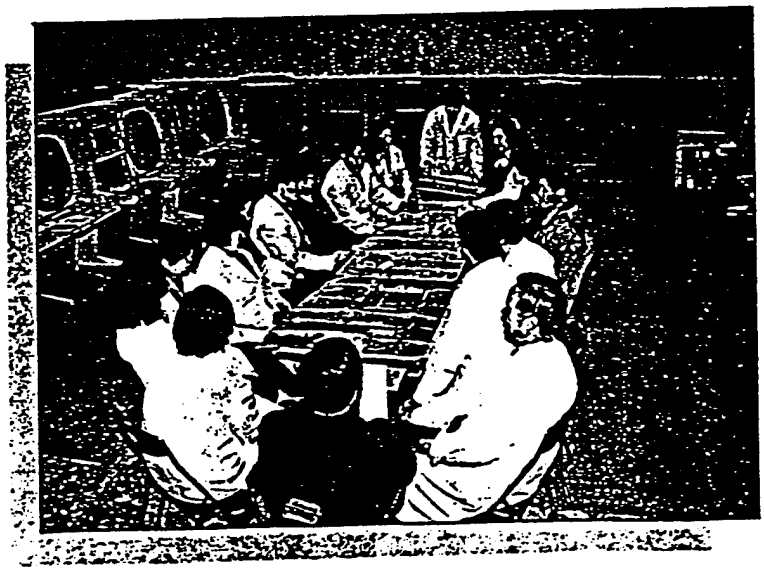
Excellent Quality Control Methods

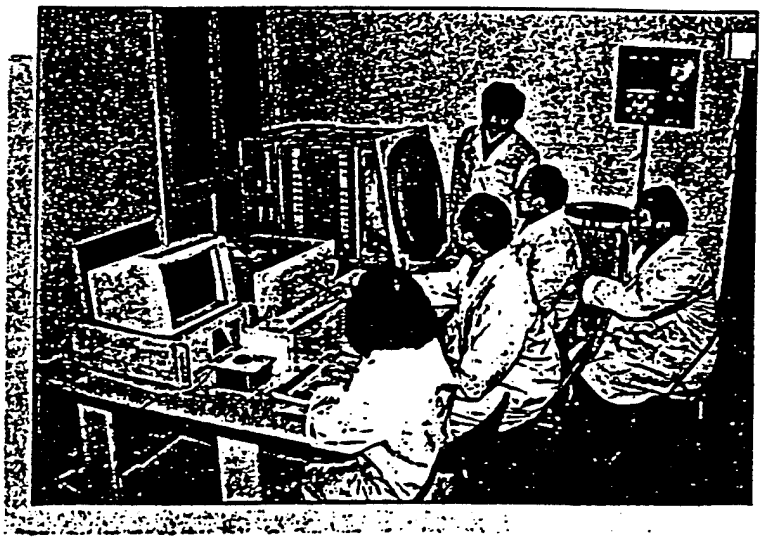
(1). Expert quality advisory committee

(2). QC team activity

(3). Tackling key quality problems







Page 20

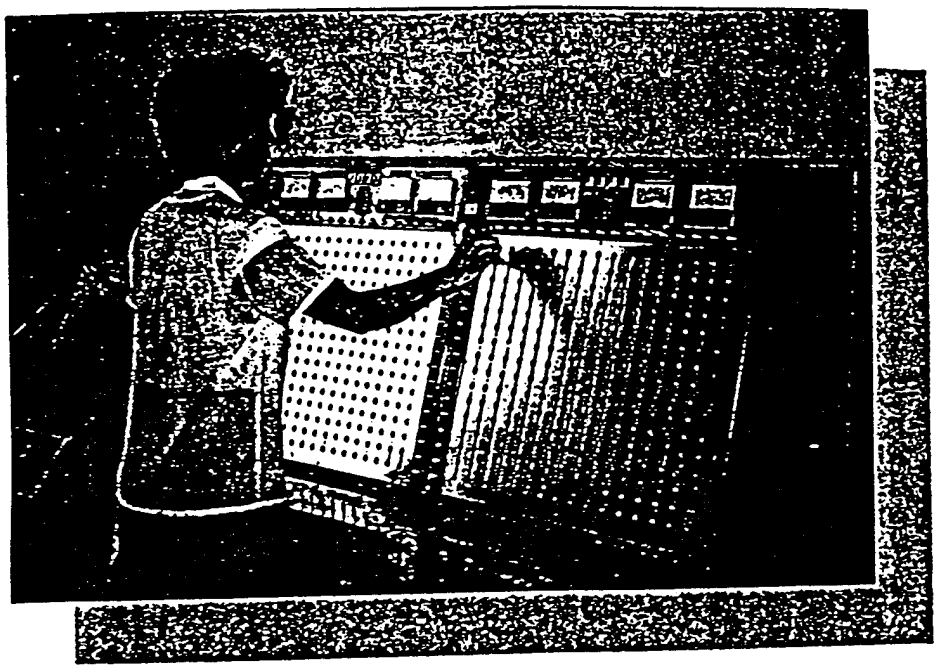
Advanced Quality Control Equipment

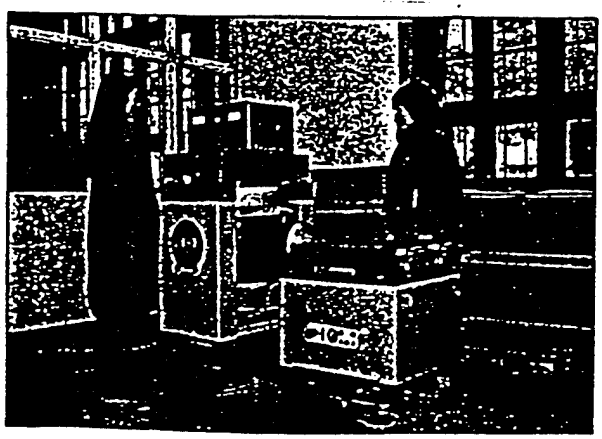
(1). Screening for aging semiconductor components

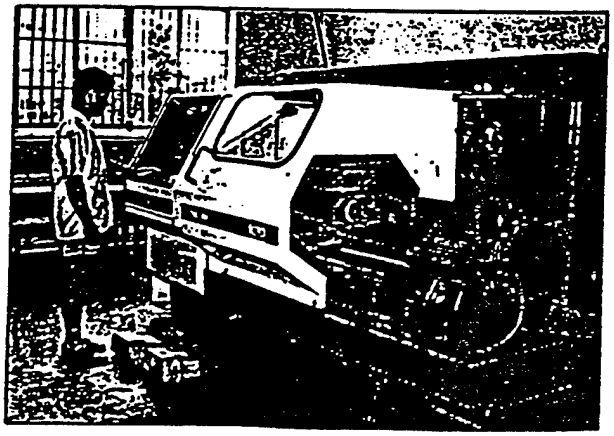
(2). High and low temperature testing

(3). Shock testing

(4). Numerical control machine







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